Test Report No. T14835-01-1 Issue 1
N95 Pre-Certification: NIOSH TEB-APR-STP-0003,
NIOSH TEB-APR-STP-0007, and NIOSH TEB-APR-STP-0059
Maple Leaf Laboratories Ltd.
MLL-1970 Respirator
28 July 2020

ACCREDITED
Test Laboratory
Certificate: 1722.01

Authorized by:

Dale Pfriem
President
ICS Laboratories, Inc.

Performed by:

Joseph Lommler
Analytical Chemist
Respiratory and Chemical Protective Equipment

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Vancouver, BC V6S 2L9
Canada

Date: 28 July 2020
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Summary:

23 MLL 1970 respirators were tested for exhalation resistance, inhalation resistance, and filtration efficiency to NIOSH standards TEB-APR-STP-0003, TEB-APR-STP-0007, and TEB-APR-STP-0059. The samples were submitted by Maple Leaf Laboratories Ltd. All samples met exhalation and inhalation resistance requirements as well as N95 filtration efficiency requirements, having exhalation resistances < 25 mmH_2O, inhalation resistances < 35 mmH_2O, and maximum penetrations < 5%.

Objectives:

Testing to: *NIOSH Procedure TEB-APR-STP-0003* Determination of Exhalation Resistance Test, Air-Purifying Respirators Standard Testing Procedure (STP) Revision: 2.4, 15 Mar 2019
NIOSH Procedure TEB-APR-STP-0007 Determination of Inhalation Resistance Test, Air-Purifying Respirators Standard Testing Procedure (STP) Revision: 2.3, 8 Mar 2019
NIOSH Procedure TEB-APR-STP-0059, "Determination of Particulate Filter Efficiency Level for N95 Series Filters against Solid Particulates for Non-Powered, Air-Purifying Respirators Standard Testing Procedure" Revision 3.2, 13 December 2019

Materials:

Model No.	*Description*	*Qty*
MLL-1970	White, folding style, N95 respirator with head straps	40

Date provided by the Client: 10 June 2020
Date Testing Authorized: 04 June 2020
Dates of tests: 27 July 2020
Manufacturer/Supplier Maple Leaf Laboratories Ltd.

Equipment:

TSI 8130 Filter Tester, configured for sodium chloride aerosol (EQ0087)
Flow Meters, Fisher & Porter Co., (EQ0098-03 & EQ0098-04) Calibrated
Digital Manometer; Dwyer Instruments, (EQ0501) Calibrated
Humidity chamber, Envirotronics (EQ0327)
Vacuum Pumps; Marathon Electric (EQ0088-04-02 &-03)
ISI Headform (EQ0477)
Mask Fixture, Custom design ICS Labs

Sodium Chloride, 99+%, Fisher Chemical, (C0015-03)

Procedure:

All tests were conducted in a standard laboratory atmosphere unless otherwise specified. The equipment and instrument calibrations were verified current and within specification prior to use. The materials for assessment were inventoried, numbered, and logged upon receipt.

The exhalation resistance test was performed in general accordance with NIOSH Procedure TEB-APR-STP-0003. A positive 85 LPM airflow through the respirator was established and the pressure difference across the respirator was determined with the digital manometer. The pressure was corrected for systemic resistance and recorded in mmH_2O column height.

Procedure (cont.):

The inhalation resistance test was performed in general accordance with NIOSH Procedure TEB-APR-STP-0007. A negative 85 LPM airflow through the respirator was established and the pressure difference across the respirator was determined with the digital manometer. The pressure was corrected for systemic resistance and recorded in mmH_2O column height.

The filter efficiency test was performed in general accordance with NIOSH Procedure TEB-APR-STP-0059. The respirators were challenged to a sodium chloride aerosol neutralized to a Boltzmann equilibrium state at 25 +/-5°C and a relative humidity of 30 +/- 10%. Particle size distribution was verified to be a count median diameter of 0.075 +/- 0.020 microns, with a geometric standard deviation not exceeding 1.86.

The respirators were conditioned at 85 % +/- 5 % relative humidity and 38°C +/- 2°C for 25 hours prior to the filter efficiency test. Three respirators were selected at random from the quantity provided. Each respirator was then assembled into a fixture and subjected to aerosol loading. The filter loading was performed by depositing 200 mg of sodium chloride aerosol at airflow rate of 85 LPM. Flow rate was monitored every 5-10 minutes on average and adjusted to maintain a flow rate of 85 LPM +/- 2 LPM. The initial flow rate, initial resistance, initial penetration, and maximum penetration data were recorded.

An aerosol loading graph for each respirator was created to determine the filter type. The respirator was identified as a Type II filter based on the performance graph. As such, the following 17 samples, selected at random, were subjected to instantaneous aerosol loading. The loading was performed by depositing sodium chloride aerosol at an airflow rate of 85 LPM for one minute. Flow rate was maintained at 85 LPM +/- 2 LPM. The flow rate, resistance, and penetration data were recorded for each respirator.

Results:

The results for the exhalation and inhalation resistance of the respirators are provided in Table I.

Table I

Breathing Resistance – MLL-1970 Respirator

Sample No.	Exhalation Resistance * (mmH_2O)	Inhalation Resistance * (mmH_2O)	Results
1970-21	6.8	7.1	Pass
1970-22	6.6	7.1	Pass
1970-23	6.5	7.1	Pass
NIOSH Specification:**	**≤ 25**	**≤ 35**	

***Resistance corrected for systemic response** ****Specification based on non-powered air purifying respirator**

Table II outlines the results of the full loading tests. All respirators followed the Type II filter profile defined by *NIOSH TEB-APR-STP-0059*.

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Results (cont.):

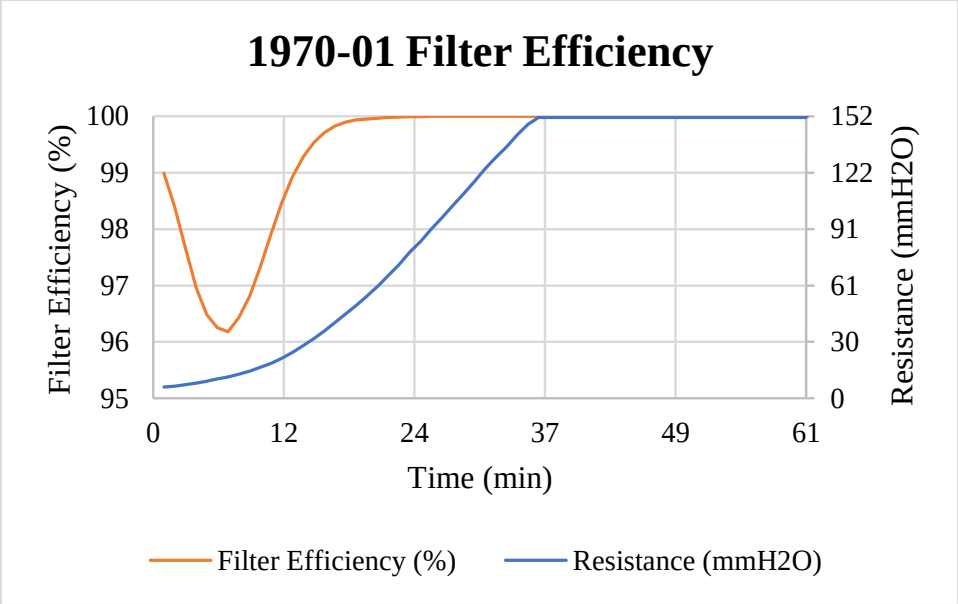
Table II
Full Loading Efficiencies – MLL-1970 Respirator

Sample ID	*Initial Flow Rate (LPM)*	*Initial Resistance (mmH_2O)*	*Initial Penetration (%)*	*Maximum Penetration (%)*	*Filter Efficiency* (%)*	*Result*
1970-01	85	6.0	1.01	3.82	96.18	Pass
1970-02	85	6.8	1.11	3.63	96.37	Pass
1970-03	85	6.5	1.10	3.83	96.17	Pass
Specification:	**81- 89**			**≤ 5.0**	**≥ 95.0**	

**Filter efficiency percent is based on maximum penetration value.*

Below are the filter efficiency and resistance graphs over the loading time for each test. Raw data tables are located in the appendix of this report.

Filter performance graph, Sample 1970-01



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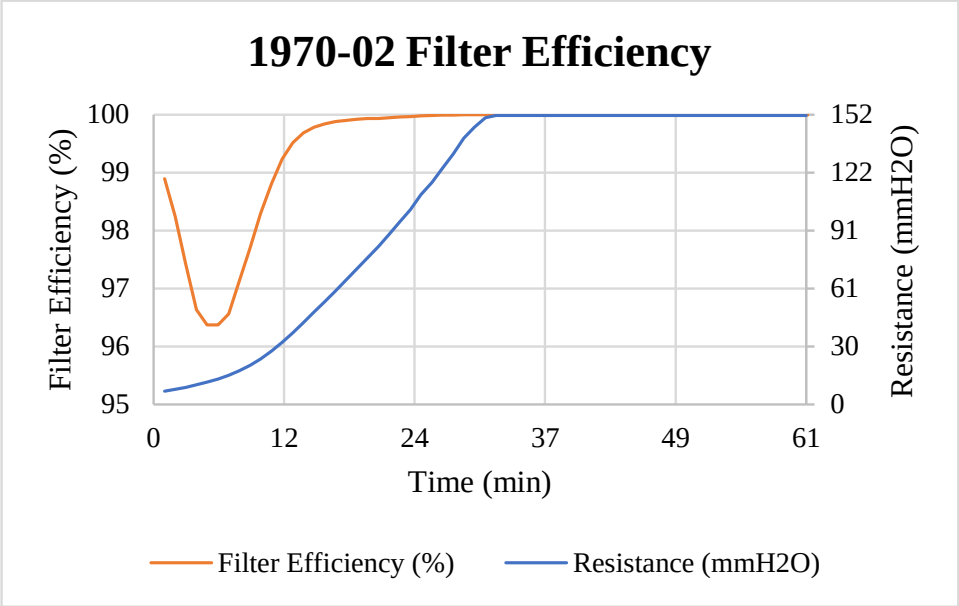
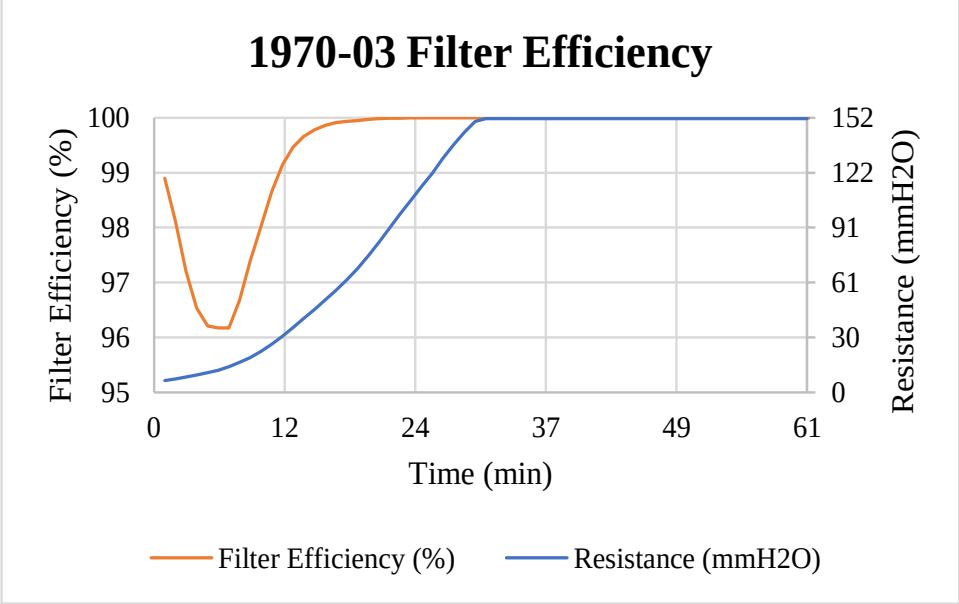
Results (cont.):

Filter performance graph, Sample 1970-02



Filter performance graph, Sample 1970-03



As outlined in TEB-APR-STP-0059, the respirator was identified as Type II filter by its loading profile. Table III outlines the 17 instantaneous aerosol loading test results for each respirator.

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Results (cont.):

Table III

Instantaneous Loading Efficiencies – MLL-1970 Respirator

Sample ID	*Flow Rate (LPM)*	*Resistance (mmH2O)*	*Penetration (%)*	*Filter Efficiency (%)*	*Result*
1970-04	85	5.9	1.03	98.97	Pass
1970-05	85	6.4	1.20	98.80	Pass
1970-06	85	6.0	1.01	98.99	Pass
1970-07	85	6.6	1.06	98.94	Pass
1970-08	85	6.2	0.94	99.06	Pass
1970-09	85	6.1	0.93	99.07	Pass
1970-10	85	6.5	1.02	98.98	Pass
1970-11	85	6.8	1.01	98.99	Pass
1970-12	85	7.3	1.12	98.88	Pass
1970-13	85	7.3	1.15	98.85	Pass
1970-14	85	6.1	0.95	99.05	Pass
1970-15	85	5.8	0.95	99.05	Pass
1970-16	85	5.8	0.89	99.11	Pass
1970-17	85	6.0	0.96	99.04	Pass
1970-18	85	5.8	0.86	99.14	Pass
1970-19	85	5.6	0.94	99.07	Pass
1970-20	85	6.3	0.99	99.01	Pass
Specification:	**81- 89**		**≤ 5.0**	**≥ 95.0**	

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Photographs:

Figure 1: MLL-1970 Respirator

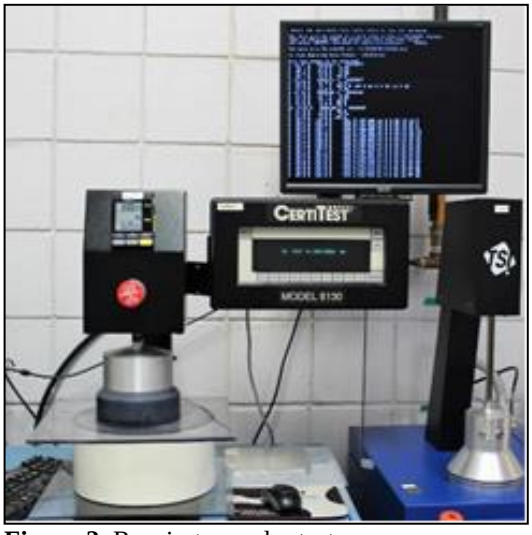

Figure 2. Respirator under test

Figure 3. Resistance measurement

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Appendix:

Loading data for Sample 1970-01

Time (min)	Flow (LPM)	Resistance (mmH_2O)	% Penetration	Time (min)	Flow (LPM)	Resistance (mmH_2O)	% Penetration	Time (min)	Flow (LPM)	Resistance (mmH_2O)	% Penetration
1	85.00	6.00	1.01	22	85.40	66.30	0.02	43	84.80	151.50	0.00
2	84.90	6.60	1.60	23	85.40	72.10	0.02	44	84.90	151.50	0.00
3	85.00	7.40	2.32	24	85.30	79.10	0.01	45	84.80	151.50	0.00
4	84.90	8.20	3.04	25	85.30	84.60	0.01	46	84.60	151.50	0.00
5	85.00	9.20	3.52	26	85.40	91.30	0.00	47	84.90	151.50	0.00
6	85.00	10.50	3.75	27	85.20	97.40	0.00	48	84.60	151.50	0.00
7	85.10	11.60	3.82	28	85.30	103.90	0.00	49	84.70	151.50	0.00
8	85.10	13.00	3.57	29	85.30	110.30	0.00	50	84.70	151.50	0.00
9	85.00	14.70	3.19	30	84.90	116.80	0.00	51	84.70	151.50	0.00
10	85.10	16.70	2.67	31	85.10	123.60	0.00	52	84.50	151.50	0.00
11	85.20	18.80	2.09	32	85.00	129.80	0.00	53	84.60	151.50	0.00
12	85.20	21.50	1.54	33	84.80	135.40	0.00	54	84.50	151.50	0.00
13	85.10	24.70	1.08	34	85.00	142.00	0.00	55	84.80	151.50	0.00
14	85.30	28.30	0.72	35	85.20	147.70	0.00	56	84.80	151.50	0.00
15	85.20	32.20	0.46	36	85.20	151.30	0.00	57	84.60	151.50	0.00
16	85.30	36.40	0.29	37	84.90	151.50	0.00	58	84.50	151.50	0.00
17	85.30	40.90	0.17	38	85.20	151.50	0.00	59	84.10	151.50	0.00
18	85.30	45.60	0.10	39	85.10	151.50	0.00	60	84.50	151.50	0.00
19	85.20	50.30	0.06	40	84.80	151.50	0.00	61	84.50	151.50	0.00
20	85.40	55.30	0.05	41	84.90	151.50	0.00				
21	85.20	60.50	0.04	42	85.20	151.50	0.00				

Loading data for Sample 1970-02

Time (min)	Flow (LPM)	Resistance (mmH_2O)	% Penetration	Time (min)	Flow (LPM)	Resistance (mmH_2O)	% Penetration	Time (min)	Flow (LPM)	Resistance (mmH_2O)	% Penetration
1	85.40	6.80	1.11	22	84.90	89.10	0.06	43	84.40	151.60	0.00
2	85.50	7.80	1.76	23	84.90	95.60	0.04	44	84.10	151.60	0.00
3	85.40	8.90	2.59	24	84.80	102.10	0.03	45	84.10	151.60	0.00
4	85.40	10.30	3.37	25	85.10	110.00	0.02	46	84.10	151.60	0.00
5	85.30	11.70	3.63	26	84.60	116.30	0.02	47	83.90	151.60	0.00
6	85.40	13.20	3.63	27	84.70	123.90	0.01	48	83.80	151.60	0.00
7	85.30	15.20	3.44	28	84.40	131.20	0.01	49	84.20	151.60	0.00
8	85.30	17.60	2.87	29	84.80	139.70	0.00	50	84.00	151.60	0.00
9	85.30	20.40	2.31	30	84.70	145.40	0.00	51	83.90	151.60	0.00
10	85.30	23.80	1.71	31	84.40	150.40	0.00	52	84.00	151.60	0.00
11	85.20	27.90	1.19	32	84.50	151.60	0.00	53	83.90	151.60	0.00
12	85.30	32.50	0.77	33	84.70	151.60	0.00	54	83.70	151.60	0.00
13	85.20	37.50	0.49	34	84.60	151.60	0.00	55	83.70	151.60	0.00
14	85.10	42.90	0.32	35	84.70	151.60	0.00	56	83.80	151.60	0.00
15	85.20	48.40	0.22	36	84.50	151.60	0.00	57	83.70	151.60	0.00
16	85.10	54.00	0.16	37	84.80	151.60	0.00	58	83.70	151.60	0.00
17	85.10	59.60	0.12	38	84.50	151.60	0.00	59	83.60	151.60	0.00
18	85.10	65.40	0.10	39	84.40	151.60	0.00	60	83.40	151.60	0.00
19	85.10	71.10	0.08	40	84.20	151.60	0.00	61	83.50	151.60	0.00
20	85.00	76.90	0.07	41	84.60	151.60	0.00				
21	85.00	82.80	0.07	42	84.40	151.60	0.00				

Loading data for Sample 1970-03

Time (min)	Flow (LPM)	Resistance (mmH_2O)	% Penetration	Time (min)	Flow (LPM)	Resistance (mmH_2O)	% Penetration	Time (min)	Flow (LPM)	Resistance (mmH_2O)	% Penetration
1	85.40	6.50	1.10	22	84.70	90.90	0.01	43	84.00	151.60	0.00
2	85.30	7.40	1.88	23	85.00	98.70	0.00	44	84.00	151.60	0.00
3	85.40	8.50	2.80	24	84.70	106.10	0.00	45	84.00	151.60	0.00
4	85.30	9.60	3.47	25	84.50	114.10	0.00	46	83.70	151.60	0.00
5	85.20	10.80	3.79	26	84.00	121.30	0.00	47	83.90	151.60	0.00
6	85.20	12.20	3.83	27	85.00	129.60	0.00	48	83.70	151.60	0.00
7	85.20	14.20	3.83	28	84.60	137.10	0.00	49	83.70	151.60	0.00
8	85.20	16.50	3.32	29	84.40	143.90	0.00	50	83.70	151.60	0.00
9	85.20	19.30	2.61	30	84.60	150.10	0.00	51	83.50	151.60	0.00
10	85.20	22.70	1.97	31	84.40	151.60	0.00	52	83.60	151.60	0.00
11	85.10	26.60	1.34	32	84.20	151.60	0.00	53	83.60	151.60	0.00
12	85.10	31.00	0.86	33	84.40	151.60	0.00	54	84.50	151.60	0.00
13	85.00	35.80	0.53	34	84.50	151.60	0.00	55	84.50	151.60	0.00
14	85.00	40.80	0.34	35	84.20	151.60	0.00	56	84.60	151.60	0.00
15	85.00	45.90	0.21	36	84.20	151.60	0.00	57	84.40	151.60	0.00
16	84.90	51.10	0.14	37	84.10	151.60	0.00	58	84.50	151.60	0.00
17	85.00	56.50	0.09	38	84.10	151.60	0.00	59	84.20	151.60	0.00
18	84.90	62.20	0.06	39	84.10	151.60	0.00	60	84.20	151.60	0.00
19	84.90	68.20	0.05	40	84.10	151.60	0.00	61	84.30	151.60	0.00
20	84.80	75.50	0.03	41	83.90	151.60	0.00				
21	84.60	83.00	0.02	42	84.10	151.60	0.00				

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15. Client agrees to pay any and all additional costs for work additional to the original scope of work as agreed to by Client.
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20. Quotations are valid for 30 days from date of issue. Standard Terms: 30% Laboratory/Testing fees invoiced and payable upon acceptance of quotation. 15 days net. Any change to these terms requires written approval by the President, Executive Vice President or Accounting Manager. ICS retains the right to require prepayment in full at any time. Cancelled jobs will be invoiced for work performed and/or set-up costs incurred. Shipping costs incurred by ICS will be invoiced at cost +10% handling fee. A minimum USD $25.00 handling fee will be invoiced on all sample returns. Shipping costs incurred by ICS will be invoiced $25.00 or cost +10%, whichever amount is higher.
21. ICS hereby objects to any conflicting terms contained in any order, acceptance or other subsequent correspondence submitted by Client.
22. In the event that payment is not received within 15 days of invoice date, Client agrees to pay a late payment charge on the unpaid balance equal to 1-1/2% per month or the maximum charge allowed by law, whichever is less, and all costs and expenses, including attorney's fees where recovery of the same is not prohibited by law, incurred by ICS in collecting such invoices.
23. All costs associated with compliance with any subpoena (s) for documents, testimony in a court of law, or for any other purpose relating to work performed by ICS in connection with work performed for that Client, shall be paid by Client. Client shall also pay costs related to deposition and trial testimony.
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